

# ANNUAL REPORT FOR 2003



**Pembroke Creek Mitigation Site**  
**Chowan County**  
**Project No. 8.T010602**  
**TIP No. R-2512**



Prepared By:  
Office of Natural Environment & Roadside Environmental Unit  
North Carolina Department of Transportation  
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## **TABLE OF CONTENTS**

<b>SUMMARY .....</b>	<b>1</b>
<b>1.0 INTRODUCTION .....</b>	<b>2</b>
1.1 Project Description.....	2
1.2 Purpose.....	2
1.3 Project History.....	2
1.4 Debit Ledger .....	4
<b>2.0 HYDROLOGY.....</b>	<b>4</b>
2.1 Success Criteria.....	5
2.2 Hydrologic Description .....	5
2.3 Results of Hydrologic Monitoring .....	7
2.3.1 Site Data .....	7
2.3.2 Climatic Data.....	10
2.4 Conclusions.....	10
<b>3.0 VEGETATION: PEMBROKE MITIGATION SITE.....</b>	<b>12</b>
3.1 Success Criteria.....	12
3.2 Description of Species .....	12
3.3 Results of Vegetation Monitoring .....	13
3.4 Conclusions .....	13
<b>4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS .....</b>	<b>14</b>

## **TABLES**

Table 1. Pembroke Creek Mitigation Site Debit Ledger .....	4
Table 2. Hydrologic Monitoring Results .....	7
Table 3. Hydrologic Monitoring Results (1999- 2002).....	8
Table 4. Vegetation Monitoring Results .....	13

## **FIGURES**

Figure 1. Site Location Map .....	3
Figure 2. Monitoring Gauge Locations .....	6
Figure 3. Hydrologic Monitoring Gauge Results.....	9
Figure 4. Historical Rainfall Data (30-70 Graph).....	11

## **APPENDICES**

Appendix A. Gauge Data Graphs.....	15
Appendix B. Site Photos .....	16

## **SUMMARY**

The following report summarizes the monitoring activities that have occurred in the past year at the Pembroke Creek Mitigation Site. The Pembroke Creek Mitigation Site in Chowan County is a bottomland forest site that is divided into two areas. The site was constructed to mitigate for the wetland impacts from the improvements to US 17 in Bertie and Chowan Counties (R-2512). In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five years or until the success criteria are fulfilled. Site construction began in 1998 and was finished in 1999.

Hydrologic success for this site is based on a comparison of mean depth of groundwater on the site to that reported from gauges in the monitored reference area (site data should fall within 20% of the reported reference data in a successful hydrologic year). The hydrologic results for 2003 indicated that the site met both jurisdictional success (i.e., the site was saturated within 12 inches of the surface for at least 12.5% of the growing season), as well as the modified criteria outlined in the plan.

The 2003-year represents the fifth successful year of vegetation monitoring. Vegetation monitoring indicated that the site has successful tree growth. The average survival over all three planting zones was 487 trees per acre. Each of the individual zones, as well as the overall site average, is above the requirement for year five (260 stems per acre).

Based on the results from the 2003 growing season and the past four successful years, NCDOT proposes to discontinue hydrology and vegetation monitoring on the Pembroke Creek Mitigation Site.

## **1.0 INTRODUCTION**

### **1.1 Project Description**

The site is located adjacent to US 17 in Chowan County (Figure 1). Designed as a bottomland forest, the site was constructed to mitigate for impacts from improvements to US 17 in Bertie and Chowan Counties (R-2512).

### **1.2 Purpose**

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five years. The following report details the results of hydrologic and vegetation monitoring during the 2003 growing season at the Pembroke Creek Mitigation Site. Included in this report are analyses of both hydrologic and vegetative monitoring results, as well as local climate conditions throughout the growing season.

### **1.3 Project History**

November 1997	Site Constructed (Phase I)
January 1998	Site Planted (Phase I)
October 1998	Vegetation Monitoring (1 yr.) (Phase I)
November 1998	Site Constructed (Phase II)
February 1999	Monitoring Gauges Installed
March-December 1999	Hydrologic Monitoring (1 yr.)
March 1999	Site Planted (Phase II)
October 1999	Vegetation Monitoring (1 yr.)
March-December 2000	Hydrologic Monitoring (2 yr.)
August, October 2000	Vegetation Monitoring (2 yr.)
March-December 2001	Hydrologic Monitoring (3 yr.)
July 2001	Vegetation Monitoring (3 yr.)
March-December 2002	Hydrologic Monitoring (4 yr.)
September 2002	Vegetation Monitoring (4 yr.)
March-December 2003	Hydrologic Monitoring (5 yr.)
October 2003	Vegetation Monitoring (5 yr.)

**Figure 1.** Site Location Map



## 1.4 Debit Ledger

The Pembroke Creek Mitigation Site has provided mitigation for several highway projects. Table 1 shows the projects that this site is providing mitigation for since completion.

**Table 1.** Pembroke Creek Mitigation Site Debit Ledger

<b>Pembroke Creek I</b>	<b>Mit. Plan</b>		<b>TIP DEBIT</b>	<b>TIP DEBIT</b>
Chowan				
Habitat	Acres At Start:	Acres Remaining	R-2512A/Bmod	
SPH Restoration	4.725	0	4.725	
TOTAL	4.725	0	4.725	
<b>Pembroke Creek II</b>	<b>Mit. Plan</b>		<b>TIP DEBIT</b>	<b>TIP DEBIT</b>
Chowan				
Habitat	Acres At Start:	Acres Remaining	R-2512 B mod	R-2404C
SPH Restoration	4.949	0	2.6	2.349
TOTAL	4.949	0	2.6	2.349

## **2.0 HYDROLOGY**

### **2.1 Success Criteria**

In accordance with federal guidelines for wetland mitigation, a site meets hydrologic criteria if it is inundated or saturated (within 12" of the surface) by surface or groundwater for at least 12.5% of the growing season (consecutive). However, discussions between NCDOT and natural resource agencies have determined that, due to the unique character of this site, the normal guidelines for hydrologic success may not apply. Groundwater levels may vary significantly on a daily basis due to a sandy substrate that is in close proximity to a tidally influenced body of water.

The growing season in Chowan County begins March 13 and ends December 1. These dates correspond to a 50% probability that air temperatures will drop to 28° or lower after March 13 and before December 1.<sup>1</sup> Thus, the growing season is 262 days; optimal wetland hydrology requires saturation/inundation for 12.5% of this growing season, or 32 days. The site must also experience average climatic conditions in order for the hydrologic data to be considered valid.

### **2.2 Hydrologic Description**

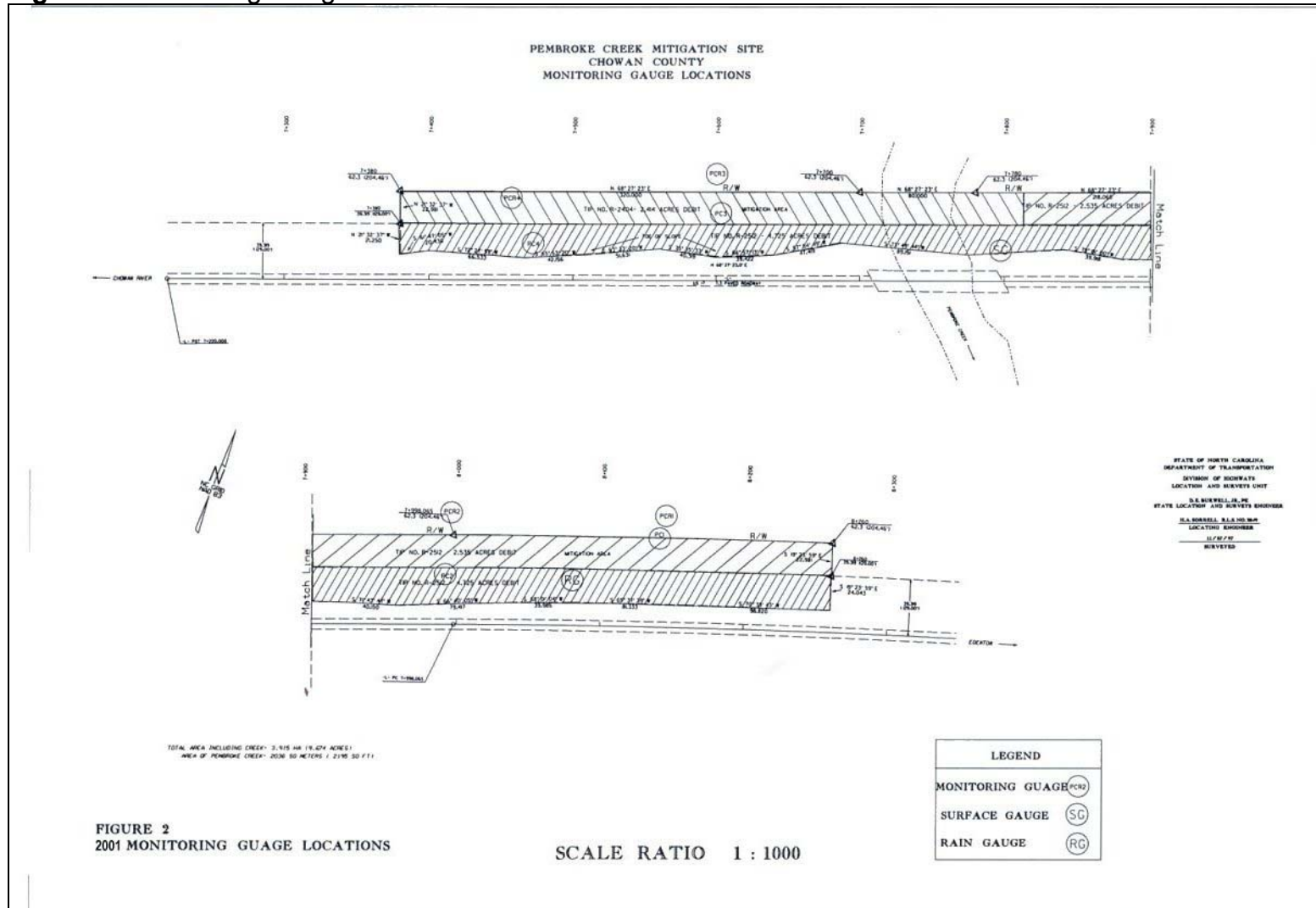
Eight groundwater-monitoring gauges (four site gauges, four reference gauges), one rain gauge, and one surface water gauge were installed onsite in February 1999; monitoring began in March 1999 (Figure 2). The automatic monitoring gauges and rain gauges record the depth to groundwater and rainfall, respectively. Data was collected on a daily basis throughout the growing season.

Appendix A contains a plot of the water depth for each monitoring gauge and surface water gauge in 2003. Precipitation events are included on each graph as bars.

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<sup>1</sup> Soil Conservation Service. Soil Survey of Chowan and Perquimans Counties, North Carolina, p.76.

**Figure 2. Monitoring Gauge Locations**





## 2.3 Results of Hydrologic Monitoring

### 2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each gauge. The number of days was then converted into a percentage of the 262-day growing season. Table 2 and Figure 3 give the results for the 2003-growing season (March 13-December 1).

**Table 2.** Hydrologic Monitoring Results

Monitoring Gauge	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %	Dates of Success
PC-1+				✗	78.2	March 14-Oct 4 Oct 28-Nov 30
PC-2+				✗	63.4	March 14-Aug 26 Sept 1-Nov 30
PC-3+				✗	100	March 14-Nov 30
PC-4+				✗	100	March 14-Nov 30
PCR-1 **				✗	100	March 14-Nov 30
PCR-2 **				✗	100	March 14-Nov 30
PCR-3 **				✗	100	March 14-Nov 30
PCR-4 **				✗	100	March 14-Nov 30

\* Reference gauge

+ Gauge met the success criterion during an average rainfall month (March, April, and November).

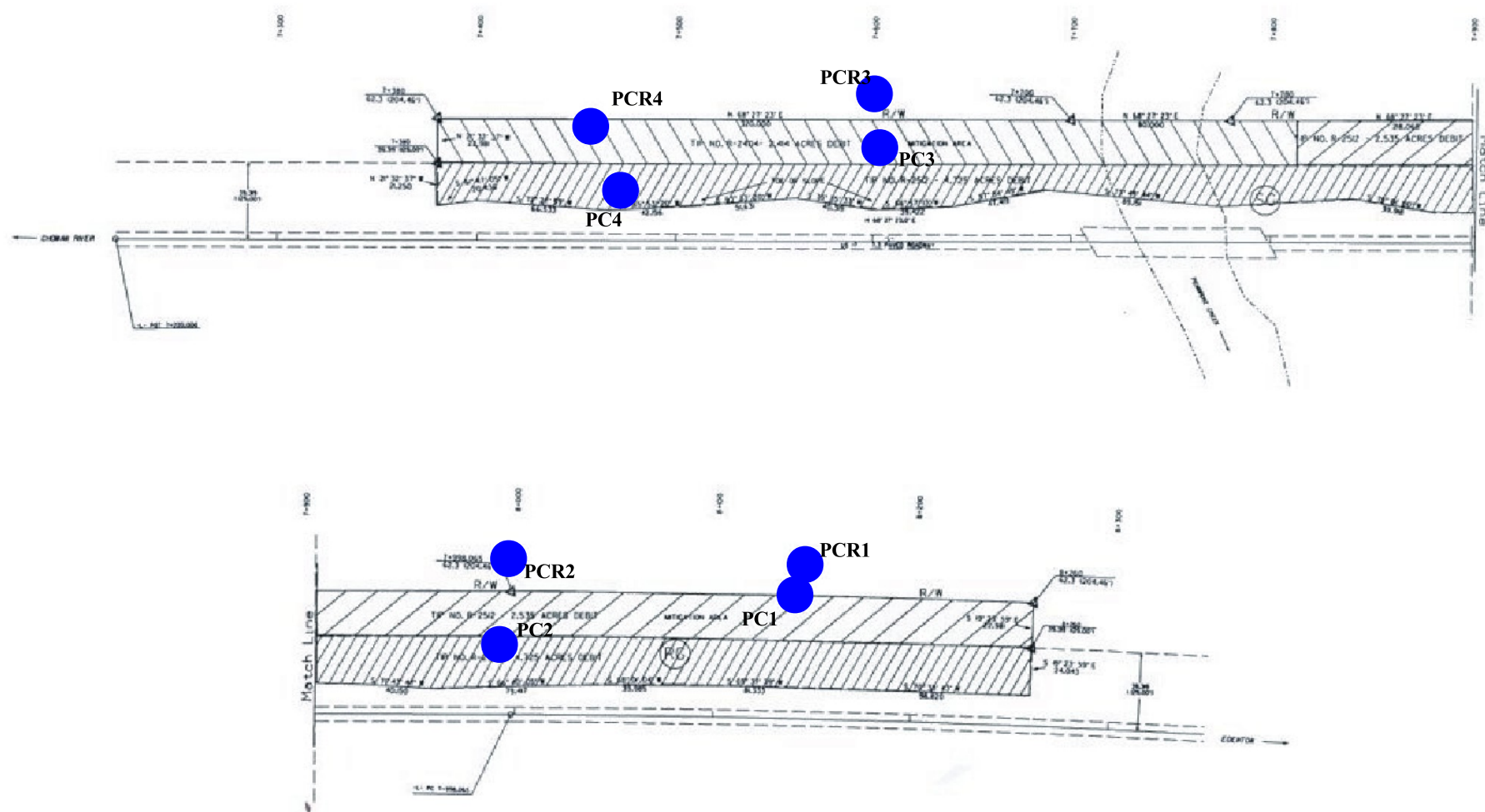
Standing water was observed throughout the growing season at the majority of the gauges.

**Table 3.** Hydrologic Monitoring Results (1999- 2002)

<b>Monitoring Gauge</b>	<b>1999 % Results Pre Hurricane</b>	<b>1999 % Results Post Hurricane</b>	<b>2000 % Results</b>	<b>2001 % Results</b>	<b>2002 % Results</b>
PC-1	66	34	100	64	100
PC-2	23	34	21	18	25.2
PC-3	66	34	100	100	100
PC-4	66	34	100	100	100
PCR-1 *	66	34	100	100	100
PCR-2 *	51	34	100	100	100
PCR-3 *	66	34	100	100	100
PCR-4 *	66	34	100	100	100
<b>Climate Conditions</b>	Average Rainfall	Average Rainfall	Average Rainfall	Average to Below Average Rainfall	Average to Below Average Rainfall

\* Reference gauge

Table 3 represents hydrologic data in percentages from previous years (1999-2002).



**Figure 3. 2003 Hydrologic Monitoring Gauge Results**

Hydrology Results

- < 5%
- 5 - 8%
- 8 - 12.5%
- > 12.5%

- ⊕ Rain Gauge
- Surface Gauge



### **2.3.2 Climatic Data**

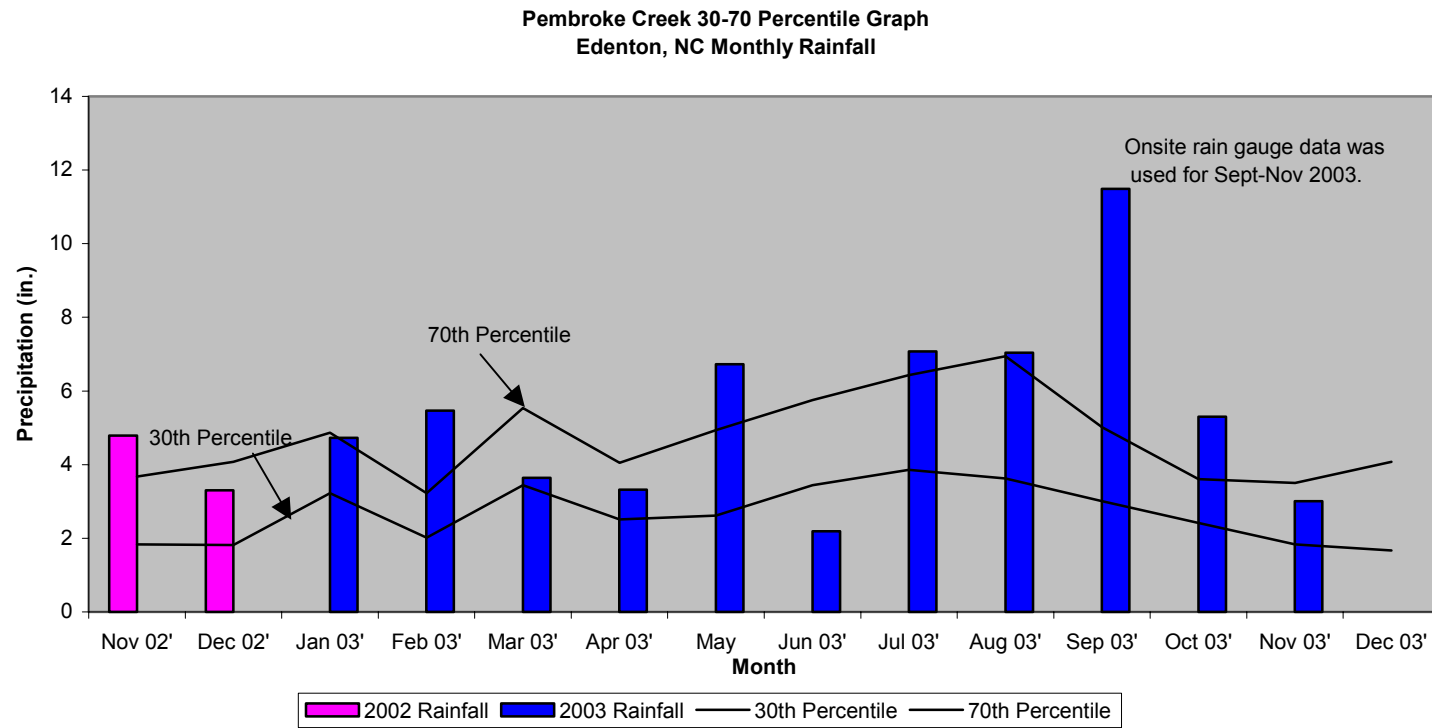
Figure 4 is a comparison of 2003 monthly rainfall to historical precipitation for the Edenton area. Rainfall data recorded onsite during the growing season was compared to the historical 30-70 percentile trends for the area. It is assumed that if the 2003 rainfall totals, represented by bars, fall between the average precipitation values for each month, then the local climate was experiencing average conditions for that particular region.

For the 2003-year, the only month to experience below average rainfall was June. The months of December (02'), January, March, April, and November all recorded average rainfall for the site. November (02'), February, May, July, August, September, and October experienced above average rainfall. The onsite rain gauge was used for the months of September-November 2003. Overall, 2003 experienced an average rainfall year.

### **2.4 Conclusions**

The hydrologic monitoring results for the 2003-year indicate that the site is successful by jurisdictional standards. The mean saturation percentage of the onsite gauges (85.4%) fell within 20% of the mean for the four reference wetland gauges (100%). The 2003-year represents the fifth consecutive year for hydrology monitoring, therefore NCDOT proposes to discontinue hydrology monitoring on the Pembroke Creek Mitigation Site.

**Figure 4. 30-70 Percentile Graph**



### **3.0 VEGETATION: PEMBROKE MITIGATION SITE (YEAR 5 MONITORING)**

#### **3.1 Success Criteria**

Success criteria state that there will be a minimum density of 320 trees per acre at year 3 and 260 trees per acre at year 5, of the approved target species surviving for at least three consecutive years.

#### **3.2 Description of Species**

The following tree species were planted in the Phase I Restoration Area:

##### **Zone 1: (0.854 HA)**

*Chamaecyparis thyoides*, Atlantic White Cedar  
*Taxodium distichum*, Baldcypress

##### **Zone 2: (0.327 HA)**

*Nyssa aquatica*, Tupelo Gum  
*Fraxinus pennsylvanica*, Green Ash  
*Quercus lyrata*, Overcup Oak  
*Taxodium distichum*, Baldcypress

##### **Zone 3: (0.468 HA)**

*Taxodium distichum*, Baldcypress  
*Nyssa aquatica*, Tupelo Gum  
*Nyssa sylvatica* var. *biflora*, Swamp Blackgum  
*Fraxinus pennsylvanica*, Green Ash

Phase II was planted in the winter of 1998-99. The following tree species were planted in the Phase II Restoration Area:

##### **Zone 1: (0.88 HA)**

*Chamaecyparis thyoides*, Atlantic White Cedar  
*Taxodium distichum*, Baldcypress

##### **Zone 2: (0.35 HA)**

*Nyssa aquatica*, Tupelo Gum  
*Fraxinus pennsylvanica*, Green Ash  
*Quercus lyrata*, Overcup Oak  
*Taxodium distichum*, Baldcypress

##### **Zone 3: (0.8 HA)**

*Taxodium distichum*, Baldcypress  
*Nyssa aquatica*, Tupelo Gum  
*Quercus lyrata*, Overcup Oak  
*Fraxinus pennsylvanica*, Green Ash

### 3.3 Results of Vegetation Monitoring

**Table 4.** Vegetation Monitoring Results

	Plot #	Baldcypress	Atlantic White Cedar	Green Ash	Overcup Oak	Tupelo Gum	Swamp Blackgum	Total (5 year)	Total (at planting)	Density (Trees/Acre)
ZONE 1	1	20	4					24	28	583
	6	13	2					15	33	309
ZONE 1 AVERAGE DENSITY										446
ZONE 2	2			18	6	4		28	30	635
	5	1		13	12	4		30	37	551
ZONE 2 AVERAGE DENSITY										593
ZONE 3	3	8				4	3	15	30	340
	4	20	1		3	7	1	32	43	506
ZONE 3 AVERAGE DENSITY										423
TOTAL AVERAGE DENSITY										487

**Site Notes:** Other species noted: cattail, woolgrass, arrowhead, phragmites, *Eleocharis* sp., *Juncus effusus*, red maple, sweetgum, black willow, *Polygonum* sp., briars, fennel, *Baccharis* sp., sycamore, jewelweed, pine, and smartweed.

### 3.4 Conclusions

The 2003 vegetation monitoring revealed an average density of 487 trees per acre. This average is well above the minimum of 260 trees per acre required by the success criteria.

NCDOT proposes to discontinue vegetation monitoring at the Pembroke Creek Mitigation Site.

## **4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS**

The Pembroke Creek Mitigation Site was monitored for hydrology and vegetation for the fifth consecutive year in 2003. The hydrologic data indicates that the site has consistently met the success by jurisdictional standards, as well as those outlined in the mitigation plan. Vegetation monitoring for the site revealed that all three planting zones met the minimum requirement for tree survival, with the site having a 487 trees per acre overall surviving density.

Based upon the results of the fifth year of monitoring data, NCDOT proposes to discontinue hydrology and vegetation monitoring on the Pembroke Creek Mitigation Site.



## **APPENDIX A**

### **GAUGE DATA GRAPHS**

**APPENDIX B**  
**SITE PHOTOS & VEGETATION PLOTS**

## Pembroke



**Photo 1**



**Photo 2**

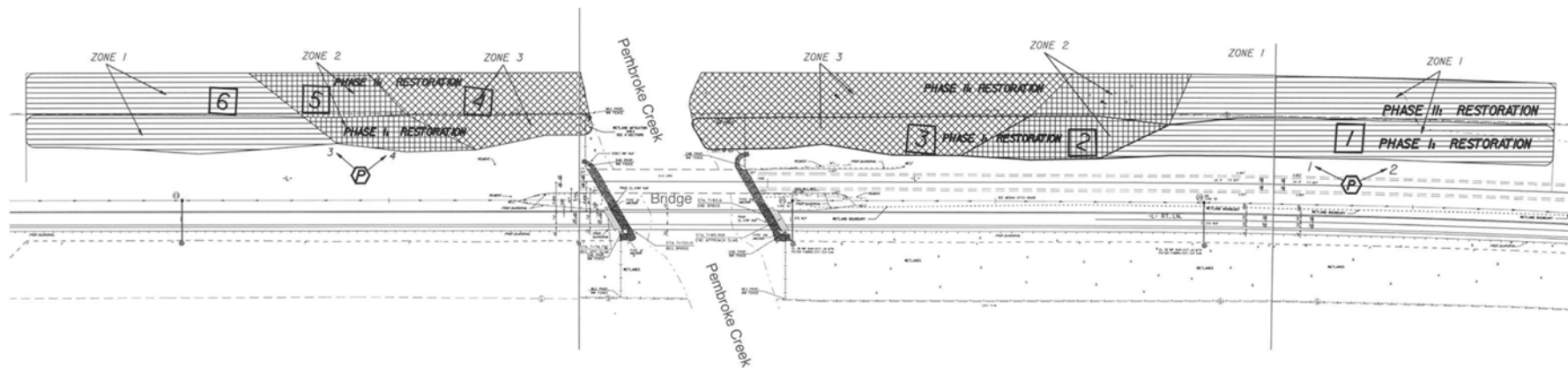


**Photo 3**



**Photo 4**

Pembroke Creek  
Mitigation Site  
Planting Plan, Plot Locations, and Photo Locations




 Plot Locations

 Photo Locations